

# NxPowerLite

## Trident Warrior 2007

### Experimentation

### And

### Results



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# Trident Warrior NxPowerLite Experimentation and Results

## Introduction and Executive Summary

The use of Microsoft Office (MS-Office) products, such as Word, Excel and Powerpoint, as well as compatible productivity suites (e.g. SUN Star Office, Google Open Office) is widespread across the US and Allied/Coalition maritime and Joint forces. These tools provide for the rich exchange of information and knowledge. In the maritime environment, however, bandwidth is limited. This rich exchange of information typically results in large document file sizes, which can be difficult to exchange between users on the WAN in the maritime, lower-bandwidth environment. The build up of large files also contributes to storage issues on the local LAN.

NxPowerLite, by NeuxPower Solutions, Ltd., is a software application that reduces the size of MS-Office (or equivalent office suites) files using image optimization technology. It is not a compression tool, such as WinZip. The output of the optimization process is an MS-Office file that retains its original document format, a Word file is still a Word file. This subtle, but important, difference means that an optimized MS-Office file can be read or edited by other parties that may not have the NxPowerLite software. Imagery and other graphics embedded in MS PowerPoint, Word and Excel documents are optimized using this tool.

The goal of Trident Warrior 07 (TW07) experimentation was to increase the effective bandwidth of the existing shipboard low bandwidth WAN connectivity by reducing the size of typical MS-Office files transmitted between ships and shore nodes, while not negatively impacting the tactical application of the documents. TW07 NxPowerLite experimentation quantitatively mapped out the extent of MS-Office (Word, Excel, PowerPoint) file size reduction via NxPowerlite optimization as a function of JPEG image quality and display/projector resolution. With this data, recommendations were developed via qualitative and quantitative assessments for optimum NxPowerLite settings for tactical use. MS-Office files were reduced by an average of 70% (and up to 95%) during the experimentation without an observable or significant loss of resolution.

One of the most user friendly aspects noted during testing was the default feature within MS Outlook that automatically gave the operator the option of optimization prior to sending presentations, documents or spreadsheets as email traffic. This automatic "one button" optimization translated to an immediate significant reduction in the both the bandwidth needed for transmission of the attachments as well as reducing network storage space without negatively impacting on the operator's productivity. NxPowerLite was found to be very easy to learn and use, significantly reducing bandwidth and network storage costs, while not negatively impacting the information being transmitted.

The significant reduction in MS-Office file sizes not only reduces network traffic over the WAN, it can also provide an effective increase in local LAN storage. Smaller MS-Office files optimized with NxPowerLite can be retained vice the much larger, non-optimized files.

As a result of Trident Warrior experimentation, the Trident Warrior 07 Military Utility Assessment (MUA) and the Sea Trial Executive Steering Group recommended that NxPowerLite (or another tool of similar capability, performance and cost) be made available across all Navy networks and be mandated as a core optimization tool of choice for all coalition networks,

## Background

As described above, NxPowerLite (often referred to as NxPlite) is an application that reduces the size of MS-Office files by optimizing and resizing images and other graphics within the file based on their size and settings. NxPowerLite Version 2.4.1 was used for experimentation by the US Navy during Trident Warrior 07. The navies of Australia, Canada, New Zealand and the United Kingdom utilized version 3.0. Versions 2.x and earlier could only optimize Microsoft PowerPoint files. NxPowerLite version 3.0 can optimize all MS-Office document types (Word, Excel and PowerPoint). NxPowerLite version 3.5, which has recently been released, also optimizes the XML versions of MS-Office 2007 (DOC, XLSX and PPTX files).

All versions of the NXPLite application have been successfully installed and operated on a wide variety of Windows operating systems, including the US Navy accredited Common Personal Computer (PC) Operating System Environments (COMPOSE), Multi-Level Thin Clients (MLTC, CENTRIXS BLK II) and Government-Off-the-Shelf (GOTS)-Delta (GOTS-D) workstations. These encompass the Windows NT SP4, Windows Server 2003, Windows XP Professional and the CITRIX Thin-Client environments. NXPLite reduced the size of Word, Excel and PowerPoint files (by as much as 95%) with no discernible loss of quality, making them easier to manage, distribute and use. Documents retained their native file format and remained fully editable, allowing them to be opened and edited by anybody with MS-Office capabilities.

Both NXPLite configurations were deployed and tested in TW07: a stand-alone configuration and an integrated configuration. The stand-alone configuration is a self-contained executable which resides on the desktop. The integrated configuration integrates tightly with MS-Office applications, MS Outlook and Windows Explorer. All user authentications for NXPLite are handled by the host operating system.

The original intention was to trial NxPowerLite version 2.4.1 during TW07. Shortly before TW07 execution, version 3.0 was released. NxPowerLite 3.0 added the ability to optimize images embedded in Microsoft (MS) Word and Excel files in addition to PowerPoint. This version also embedded the automatic optimization capabilities into MS Outlook, ensuring that all emails sent with Word, Excel and/or PowerPoint attachments could be optimized before being transmitted over the network. Both versions can be run as a stand-alone software or integrated with MS-Office, Outlook and Windows. All nations except the US deployed version 3.0 in TW07. NxPowerLite 3.5 has also been tested in the COMPOSE environments, with similar results. As noted above, it now optimizes all MS-Office 2007 file formats and is backwards compatible with earlier versions of MS-Office.

NxPowerLite has two settings: standard and custom. Within the standard settings there are;

- high quality – (lowest optimization, largest file size)
- normal
- extra
- mobile device – (highest optimization, smallest file size)

The custom setting allows the following screen/projector resolutions and JPEG image quality levels to be adjusted:

- Screen Resolution: 1600x1200, 1280x1024, 1024x768, 800x600, 640x480, 320x240
- JPEG Image Quality: 1 (lowest) to 9 (highest)

Thus the NxPowerLite optimization settings can be tuned to optimize knowledge transfer and minimize bandwidth utilization in the tactical maritime environment.

### Experimentation with NXPowerLite Version 2.4.1

To quantitatively map out the extent of PowerPoint optimization as a function of JPEG image quality and screen resolution, four controlled PowerPoint files were generated and tested in the lab (Phases 1-4) with Phase 5 being the At-Sea testing. The PowerPoint files contained the following:

- Phase 1: a PowerPoint file of 10 slides containing only images.
- Phase 2: a PowerPoint file of 10 slides containing only embedded Excel charts (4 X-Y charts, 3 Bar Charts, 1 Area Chart, 1 Pie chart and 1 Torus Chart),
- Phase 3: a PowerPoint file of 10 slides containing only graphics. File size reduction as well as readability of the graphics will be noted (TW07 OV-1 graphic, Visio Network Diagrams, Cut and Paste from PDF files, slides with Clipart, etc.).
- Phase 4: a PowerPoint file of 10 slides containing a mix of images, charts, graphics and text, representative of a “typical” brief.
- Phase 5: At-sea during TW07, various PowerPoint presentations produced by operators during TW07, whose contents reflect that generated by the Fleet in daily operations, were used to evaluate the optimization performance.

### Experimentation with NXPowerLite Version 3.0

To measure and compare results, for each MS-Office file type (Word, Excel and PowerPoint) three large files (of at least 5 Mbytes long each) were generated as follows:

- One file with embedded graphic images (photos) only;
- One file with text only;
- One file with an equal amount of images and text (i.e. equal number of slides with images to text)
- One large PowerPoint file with animations and slide transitions (using MS PowerPoint custom animation features) was also generated

The four files were optimized at different levels: high quality, normal, extra and mobile. File size reductions were noted at different levels of optimization and settings.

### NxPowerLite Version 2.4.1 - Experimentation Results

**Phase 1 – Pictures Only:** The results of the NXPowerLite Optimization of the *Pictures Only Test.ppt* with imagery are shown in Table , below. Ten slides were prepared with a unique JPEG file obtained from a digital camera (avg 1.5Mbyte in size) on each slide at full size. High Quality, Normal, Extra Compression and Mobile are mapped to specific Custom settings. These results are then displayed in Figure 1 and Figure 21. Figure 1 illustrates the dramatic reduction in file size obtained even at the High Quality setting. Figure 2 provides a close-up view of the optimization results. This allows us to determine the best trade-offs between file size and optimization settings. The “sweet spot” zone for this particular test was bounded by 800x600 to 1024x768 resolution, and JPEG Quality 6 to 7, This corresponds closely with the default Normal and Extra Compression settings.

JPEG Level	1600x1200	1280x1024	1024x768	800x600	640x480	320x240
Unoptimized	15,358,464 bytes					
High Quality	3521536					
Normal	640512					
Extra Compression	433152					
Mobile	91648					
1	546816	381952	271360	189440	142336	73168
2	697344	489984	347136	241152	177664	82432
3	843776	591360	417792	288768	210944	92672
4	978944	684032	482304	331264	240128	101376
5	1117184	776704	545280	372224	268288	109568
6	1335808	922604	640512	433152	308736	121856
7	1675776	1148416	789504	526336	370688	140288
8	2405888	1638400	1114112	730624	504320	177664
9	4752384	3244032	2200064	1428992	969216	304640

Table 1 - PowerPoint File Optimization – Pictures Only

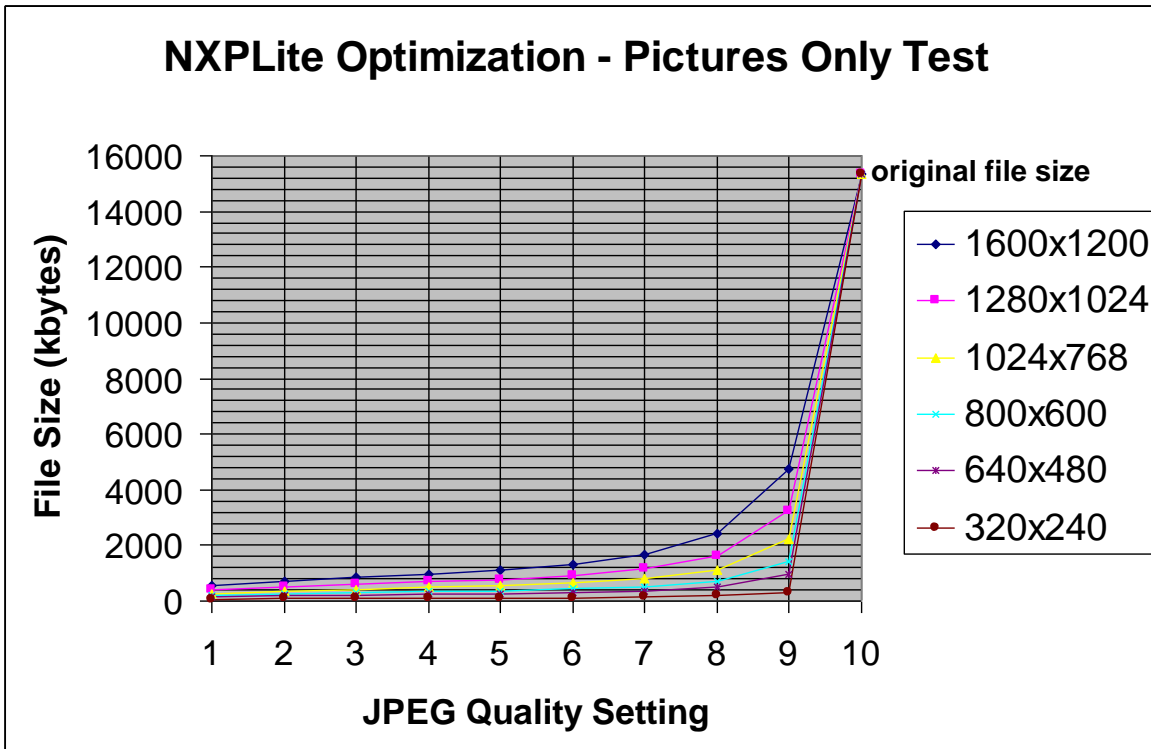


Figure 1 - Optimization of PowerPoint File Containing Only Pictures

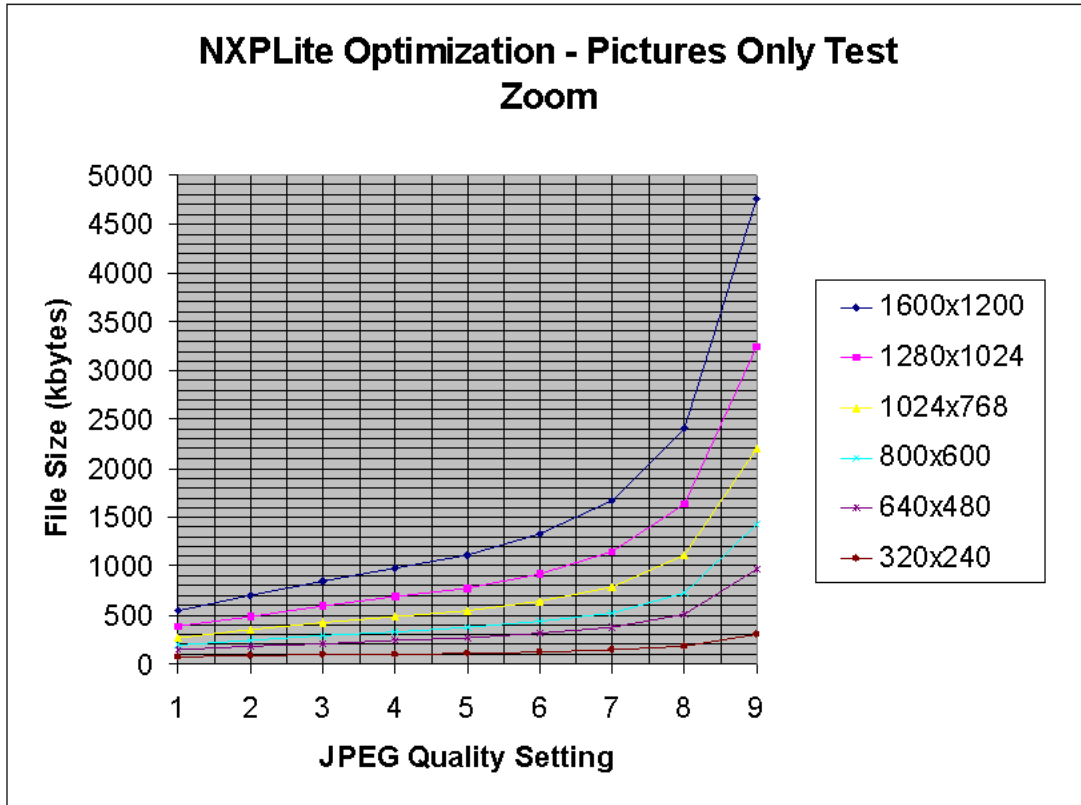


Figure 21 - Zoom to Determine the Best Screen Resolution and JPEG Quality Settings

**Phase 2 – Charts Only:** Ten unique Excel charts were prepared and inserted into a PowerPoint brief, with a single chart on each slide at full-size. The results are delineated in Table 22 below. The JPEG Quality settings did not have any effect on the Optimized file size, leading to speculation that the embedded charts are not JPEG images, but probably GIF images. File sizes were reduced 55%.

JPEG Level	1600x1200	1280x1024	1024x768	800x600	640x480	320x240
Unoptimized	218,624 kbytes					
High Quality	94208					
Normal	94208					
Extra Compression	94208					
Mobile	94208					
1	98304	98304	98304	98304	98304	98304
2	98304	98304	98304	98304	98304	98304
3	98304	98304	98304	98304	98304	98304
4	98304	98304	98304	98304	98304	98304
5	98304	98304	98304	98304	98304	98304
6	98304	98304	98304	98304	98304	98304
7	98304	98304	98304	98304	98304	98304
8	98304	98304	98304	98304	98304	98304
9	98304	98304	98304	98304	98304	98304

Table 2 - NxPowerLite Optimization of Excel Charts in a PowerPoint File

**Phase 3 – Graphics Only:** A ten slide PowerPoint file *Graphics Test.ppt* was tested at the Resolution and JPEG settings delineated in Table . This file contained a wide variety of Clip Art and Graphics used in presentations on each slide.

JPEG Level	1600x1200	1280x1024	1024x768	800x600	640x480	320x240
Unoptimized	16,830 kbytes					
High Quality	8500					
Normal	6057					
Extra Compression	5937					
Mobile	5707					
1	6140	5983	5864	5747	5671	5552
2	6191	6034	5914	5796	5720	5600
3	6236	6078	5958	5839	5763	5642
4	6270	6112	5991	5872	5795	5674
5	6298	6140	6019	5899	5822	5701
6	6338	6179	6057	5937	5860	5737
7	6392	6232	6110	5989	5911	5788
8	6488	6327	6204	6081	6002	5877
9	6647	6484	6358	6230	6148	6018

**Table 3 - NxPowerLite Optimization of Graphics and Clip Art in a PowerPoint File**

These results are displayed in Figure 2 and Figure . Optimizing the graphics-only file took about 30 seconds, while the other three file types took <10 seconds. The ability to determine preferred settings for Graphics and Clip Art are slightly less clear-cut than those for JPEG Images in the **Images Only** test. However, the same “sweet spot” zone, bounded by 800x600 to 1024x768 resolution, and JPEG Quality 6 to 7, is appropriate and corresponds closely with the default Normal and Extra Compression settings.

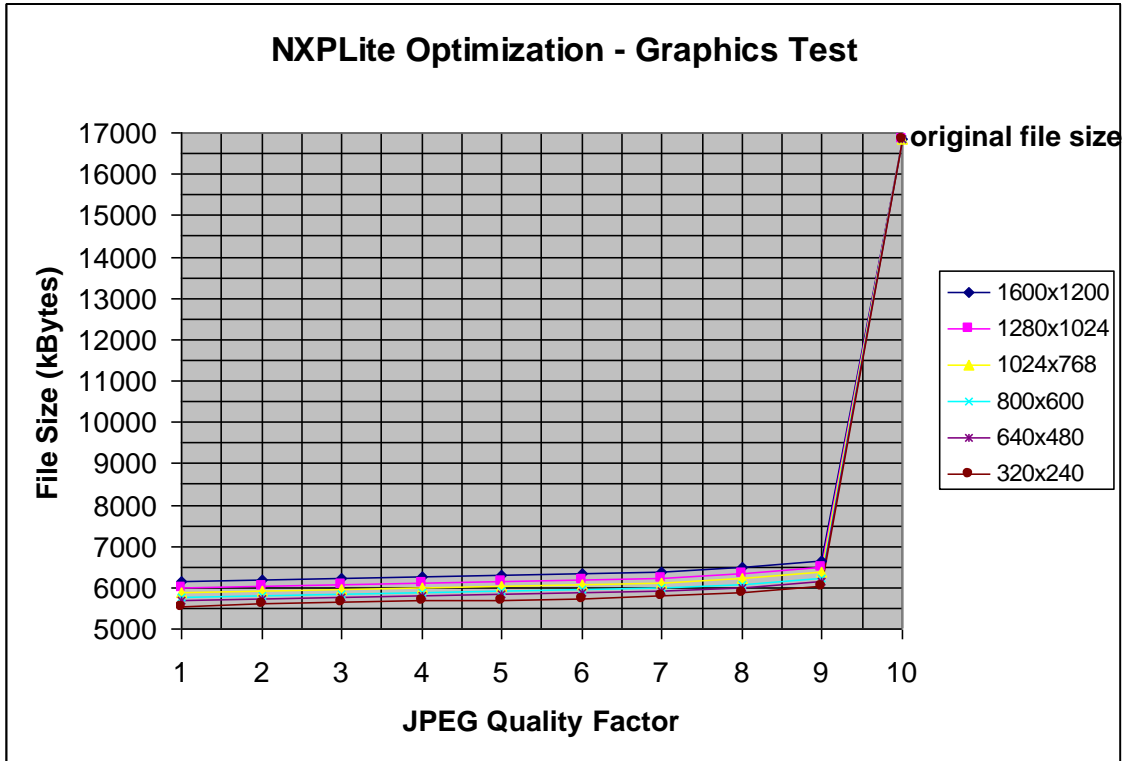


Figure 2 - NxPowerLite Optimization of File Containing Only Graphics & Clip Art

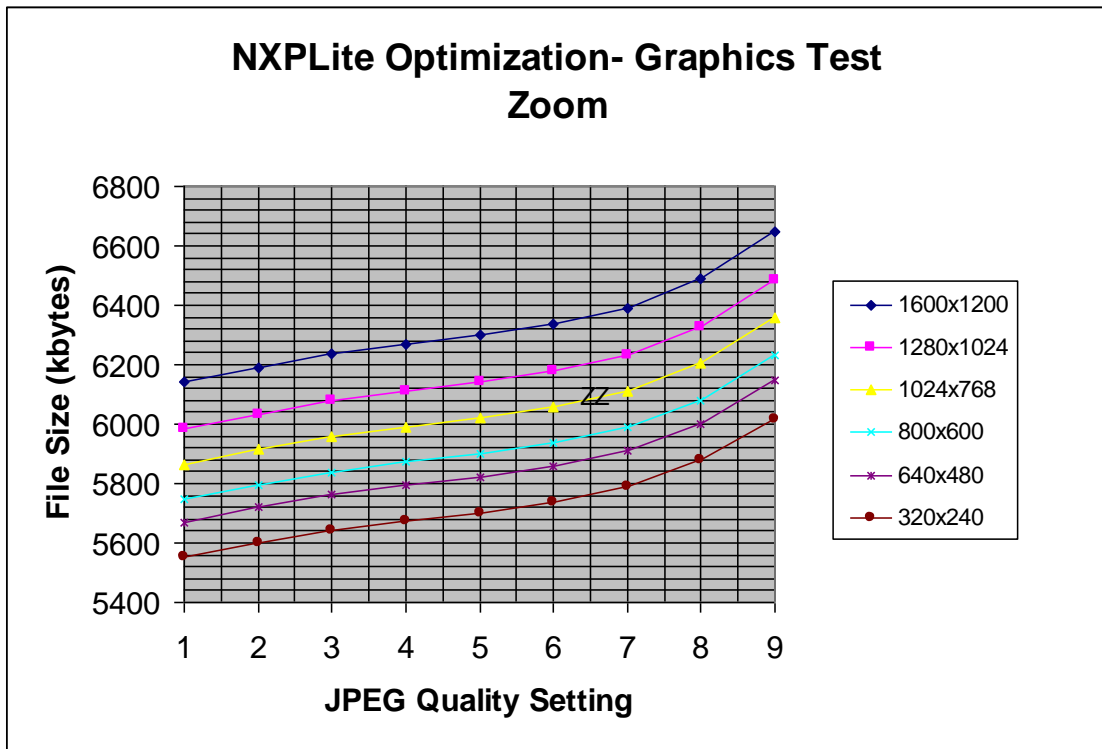


Figure 4 - Zoomed View of NxPowerLite Optimization of Graphics & Clip Art

**Phase 4 – Mix of Elements:** A representative 10-slide brief, *Mix of Elements Test v2.ppt*, was prepared that contained a mix of **Graphics** (TW07 OV-1, One Visio Network Diagram, One PowerPoint Network Diagram), **Images** (1 slide with full JPEG image), **Charts** (1 Embedded Excel Spreadsheet, 2 Embedded Excel Charts) and **Text** (3 Text Only Slides). The results of NxPowerLite Optimization for this test are shown in Table and in Figures 5 and 6.

JPEG Level	1600x1200	1280x1024	1024x768	800x600	640x480	320x240
Unoptimized	4,749,824					
High Quality	1,759,232					
Normal	762368					
Extra Compression	703488					
Mobile	592896					
1	731136	698880	674304	644096	619008	580096
2	762368	723968	693760	657920	629248	585728
3	786944	742400	708608	669696	637952	589824
4	810496	759808	722944	679936	645632	594432
5	842240	786432	745472	689152	652800	598016
6	872448	808960	762368	703488	663552	603136
7	914944	840704	785920	723968	678400	609792
8	1004544	905,728	835072	760320	703488	618496
9	1,243,648	1076736	952832	855552	781824	641536

Table 4 - Optimization of a Mix of Graphic, Clip Art and Imagery Elements

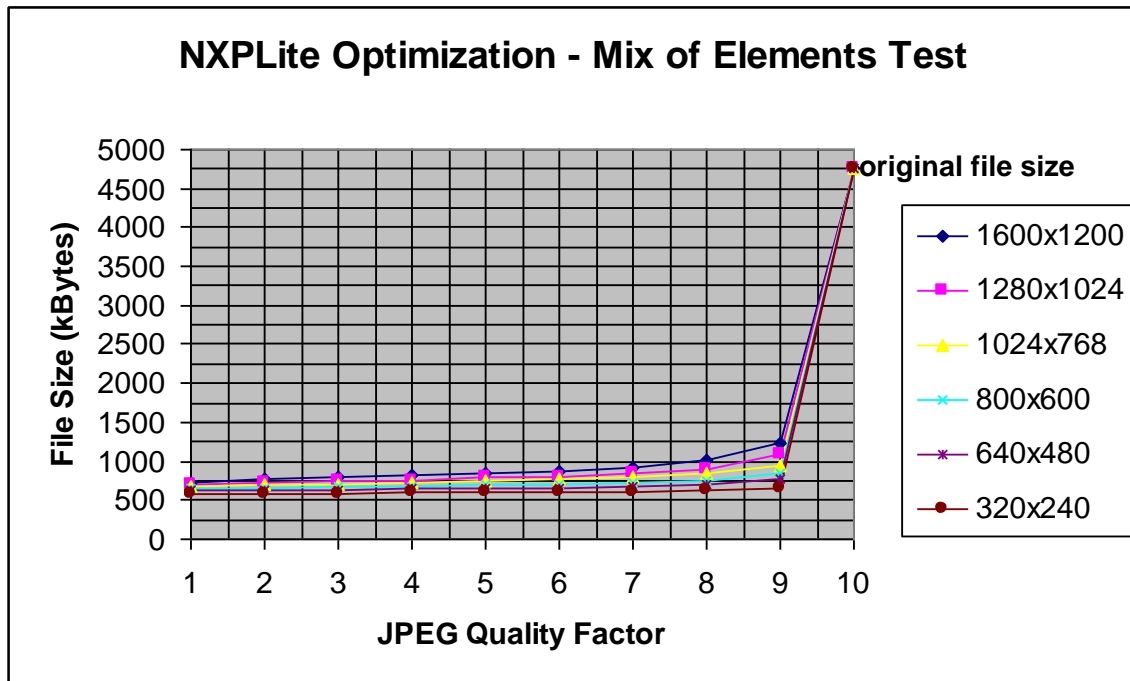


Figure 5 - Optimization of a Mix of Graphic, Clip Art and Imagery Elements



**Figure 3 - Zoom of Optimization of a Mix of Graphic, Clip Art and Imagery Elements**

This “mix of elements” test is more representative of real-world PowerPoint files. From Figure 3 above, it is possible to determine optimum settings, trading off image quality and screen resolution. The “sweet spot” is somewhere in the area bounded by JPEG Quality 6 – 8 and Screen Resolution of 800x600 to 1280x1024. Again, this corresponds with the Normal and Extra Compression settings. The drastic reduction between the original file size and the Optimized files illustrates the effectiveness of NXPowerLite in resizing images contained in a PowerPoint file.

**Phase 5 – At-Sea Test:** While underway with the HARRY S TRUMAN Strike Group during TW07, a large number of Fleet briefings were processed by NxPowerLite. These briefings were those prepared by the operational community in the course of daily operations and represent a broad spectrum of briefing types, styles and sizes. Content was not governed or controlled, as this was to test NxPowerLite in the “real world.” The following Tables and Figures illustrate how NxPowerLite optimized these briefs during the TW07 at-sea phase. For ease of viewing, we have separated the data into two sections: files larger than 5 Mbytes and files smaller than 5 Mbytes. **Error! Reference source not found.**, 6 and 7 below show how NxPowerLite optimized individual files during the underway period of TW07. The NxPowerLite default settings were used in these tests.

<b>Original MS-Office Files (Kbytes):</b>	<b>High Quality % Reduction</b>	<b>Normal % Reduction</b>	<b>Extra % Reduction</b>	<b>Mobile % Reduction</b>
<b>17200</b>	89.6%	95.1%	95.7%	95.0%
<b>16400</b>	49.4%	64.0%	64.6%	65.9%
<b>14700</b>	76.9%	95.7%	97.1%	99.4%
<b>13920</b>	90.1%	91.6%	92.0%	93.4%
<b>13600</b>	90.4%	91.9%	91.9%	93.2%
<b>13500</b>	91.1%	92.4%	92.8%	94.3%
<b>13400</b>	90.9%	92.4%	92.8%	94.2%
<b>12700</b>	71.7%	78.0%	78.7%	83.5%
<b>11100</b>	69.7%	85.9%	88.0%	93.6%
<b>9900</b>	92.2%	97.8%	98.3%	99.0%
<b>9800</b>	92.3%	98.0%	98.4%	99.1%
<b>9800</b>	92.4%	98.1%	98.5%	99.2%
<b>9300</b>	60.2%	64.5%	64.5%	66.7%
<b>6100</b>	50.8%	52.5%	54.1%	55.7%
<b>6030</b>	71.1%	85.4%	89.8%	97.4%
<b>5219</b>	83.8%	83.6%	88.4%	97.6%
<b>Average Optimization</b>	<b>78.91%</b>	<b>85.43%</b>	<b>86.60%</b>	<b>89.20%</b>

**Table 5: Files Larger Than 5Mbytes Before Optimization**

<b>Original MS-Office Files (Kbytes):</b>	<b>High Quality % Reduction</b>	<b>Normal % Reduction</b>	<b>Extra % Reduction</b>	<b>Mobile % Reduction</b>
<b>4900</b>	40.6%	54.5%	58.8%	66.3%
<b>4730</b>	32.4%	32.9%	32.9%	32.9%
<b>4700</b>	49.4%	65.1%	74.3%	93.1%
<b>4500</b>	62.2%	83.5%	84.7%	87.1%
<b>4200</b>	23.8%	52.4%	54.8%	59.5%
<b>2900</b>	24.1%	55.2%	62.1%	71.8%
<b>2300</b>	30.4%	66.6%	71.2%	80.2%
<b>1900</b>	52.4%	71.6%	72.0%	72.8%
<b>1900</b>	10.5%	47.4%	52.1%	64.1%
<b>1019.5</b>	32.6%	62.5%	66.8%	80.7%
<b>998</b>	31.6%	61.7%	66.6%	80.8%
<b>977</b>	24.3%	56.0%	63.6%	80.5%
<b>901.5</b>	81.0%	83.6%	84.5%	86.0%
<b>351</b>	18.8%	54.4%	63.5%	79.5%
<b>176</b>	26.4%	39.9%	44.6%	55.4%
<b>170</b>	27.6%	41.5%	46.2%	57.4%
<b>86.5</b>	3.5%	3.5%	3.5%	3.5%
<b>85</b>	12.4%	12.4%	12.4%	12.4%
<b>30</b>	16.7%	16.7%	16.7%	16.7%
<b>Average Optimization</b>	<b>31.62%</b>	<b>50.60%</b>	<b>54.28%</b>	<b>62.14%</b>

**Table 6: Files Smaller Than 5Mbytes Before Optimization**

	<b>High Quality % Reduction</b>	<b>Normal % Reduction</b>	<b>Extra % Reduction</b>	<b>Mobile % Reduction</b>
<b>Average Optimization Files &gt; 5Mb</b>	<b>78.91%</b>	<b>85.43%</b>	<b>86.60%</b>	<b>89.20%</b>
<b>Average Optimization Files &lt; 5Mb</b>	<b>31.62%</b>	<b>50.60%</b>	<b>54.28%</b>	<b>62.14%</b>
<b>Average Optimization All Files</b>	<b>53.2%</b>	<b>66.5%</b>	<b>69.1%</b>	<b>74.5%</b>

**Table 7: Average Optimization for All Fleet Files**

Larger files typically contain more graphics and images than the smaller files. As can be seen in Figure 7 (below), in 80% (12 or 15) of the large briefs, NxPowerLite provided 85% optimization or better if Normal or Extra Compression was utilized. It should be noted that operators indicated that the Mobile Device setting provided graphics that were of inferior quality and not very useful on PC displays.

The effects of NxPowerLite Optimization on small (zero or minimal graphics) and medium sized files can be observed in Figure 8. With the reduction in graphics, NxPowerLite is not able to achieve the remarkable file size reductions observed in larger, more graphics-intensive files. For files greater than 300 Kbytes in size, optimizations in excess of 50% were achieved in 13 of 14 files using Normal or Extra Compression. Optimizations of 65% or greater were achieved in 10 of 14 files using Extra Compression. Even smaller files with minimal graphics observed 40% optimization. Only the smallest files (< 100 Kbytes) did not benefit greatly from the NxPowerLite optimization process.

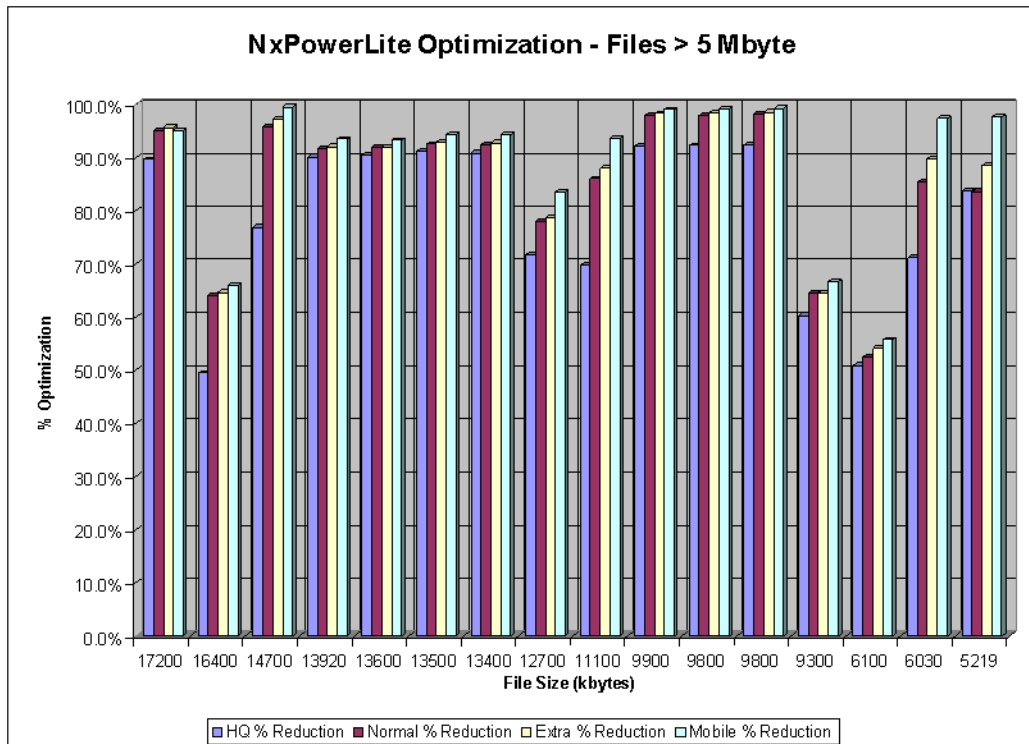
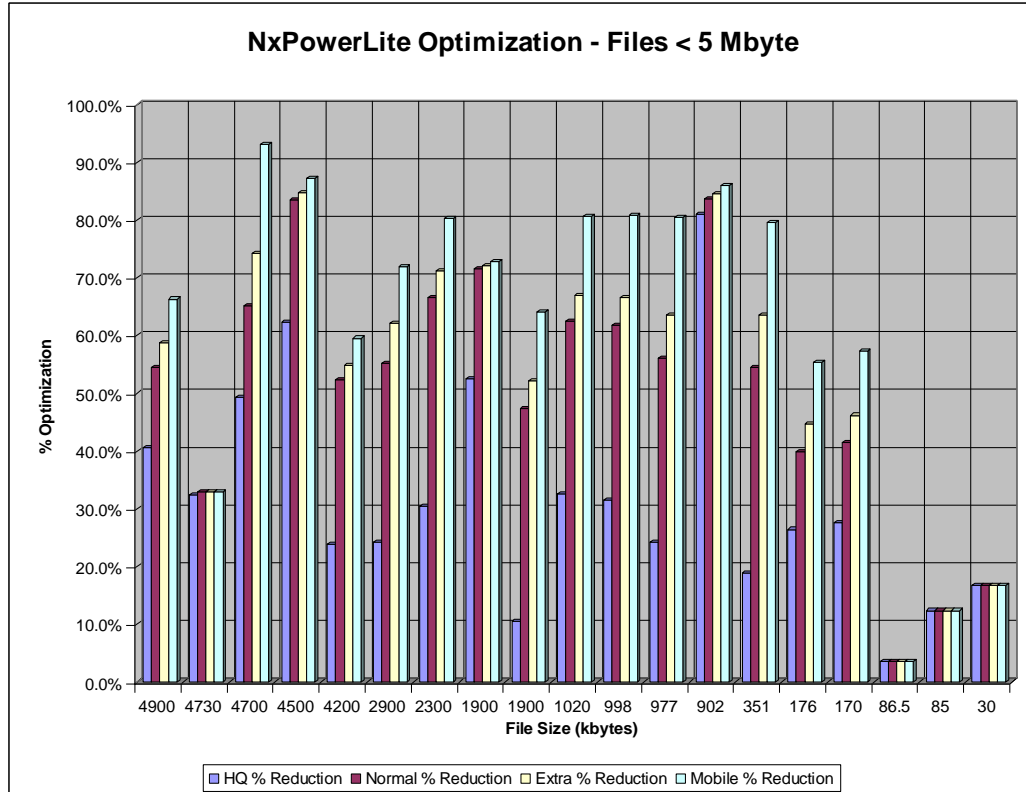


Figure 7 - NxPowerLite Optimization of Large MS-Office Files



**Figure 8 - NxPowerLite Optimization of Small and Medium-Sized Files**

To recap, an ensemble average of NxPowerLite optimization across all file sizes was computed and found

- the High Quality setting reduced file size by 53%
- the Normal setting reduced file size by 66%
- the Extra Compression setting reduced file size by 69%
- the Mobile Device setting reduced file size by 75%.

The operators noted that the Mobile Device setting resulted in images and graphics that were too coarse for the typical PC display, though they would be fine for smaller, lower resolution PDA displays.

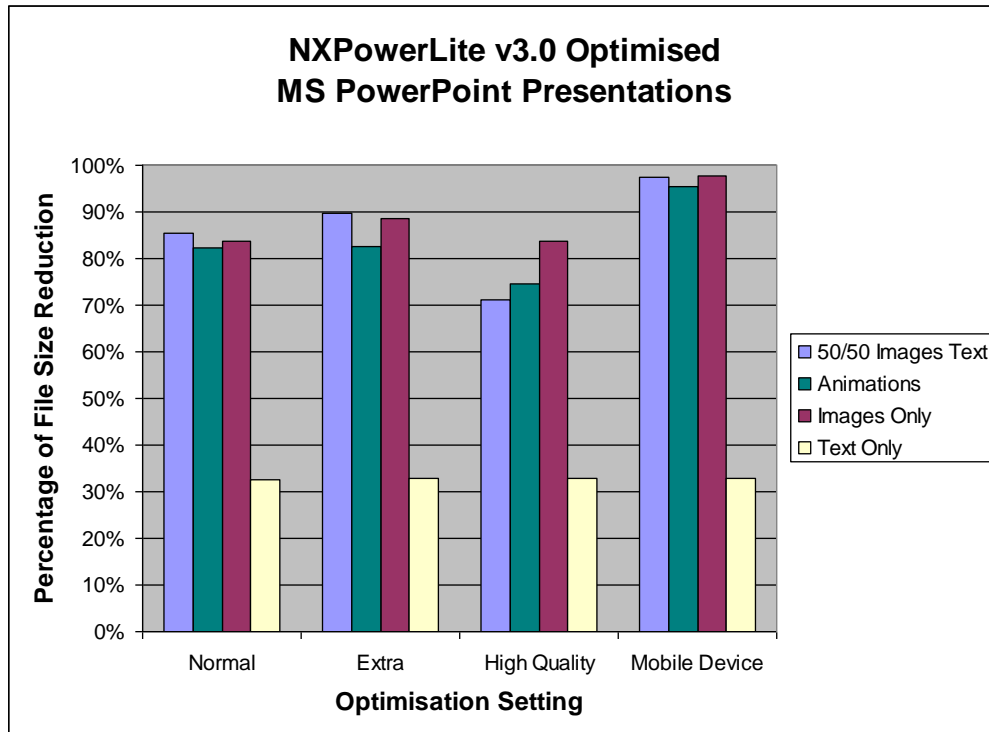
### NxPowerLite Version 3.0 Experimentation

**Error! Reference source not found.** below shows the original and optimized files sizes for a range of MS Office documents optimized by NxPowerLite Version 3.0. NxPowerLite provided a significant reduction in file size even at the lowest level of optimization (high quality).

PowerPoint	Original (Kbytes)	High Quality (Kbytes)	Per Cent Red.	Normal (Kbytes)	Per Cent Red.	Extra Comp. (Kbytes)	Per Cent Red.	Mobile Device (Kbytes)	Per Cent Red.
50/50 Mix of Images & Text	6030	1740.8	71.13%	879	85.42%	618	89.75%	159	97.36%
Animations	6453	1638.4	74.61%	1143	82.29%	1126.4	82.54%	287	95.55%
Images	5219	847	83.77%	857	83.58%	603.5	88.44%	125.5	97.60%
Text	4730	3174.4	32.89%	3196	32.43%	3174.4	32.89%	3174.4	32.89%
Word	Original	High Quality		Normal		Extra		Mobile	
50/50 Mix of Images & Text	6275	1843.2	70.63%	2202	64.91%	1024	83.68%	1024	83.68%
Images Only	6562	1843.2	71.91%	1750	73.33%	965.5	85.29%	965.5	85.29%
Text Only	7002	3174.4	54.66%	3126	55.36%	3174.4	54.66%	3174.4	54.66%
Excel	Original	High Quality		Normal		Extra		Mobile	
50/50 Mix of Images & Text	5025	977	80.56%	977	80.56%	977	80.56%	977	80.56%
Images Only	6428	1740.8	72.92%	1729	73.10%	1740.8	72.92%	1740.8	72.92%
Text Only	5937	5836.8	1.69%	5883	0.91%	5836.8	1.69%	5836.8	1.69%

**Table 8 - NxPowerLite 3.0 Optimization of MS-Office Files**

The above results are illustrated below in Figure 9 (PowerPoint), Figure 10 (Word) and Figure 11 (Excel).



**Figure 9 - NxPowerLite Version 3.0 MS-PowerPoint Optimization**

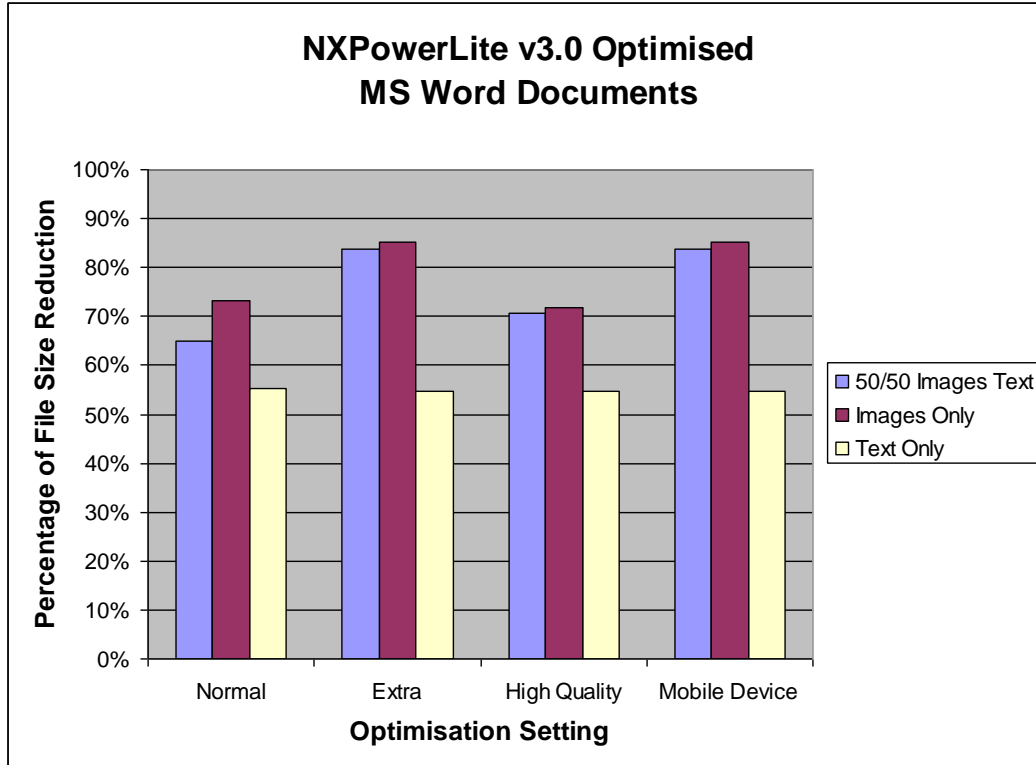


Figure 10 - NxPowerLite Version 3.0 MS-Word Optimization

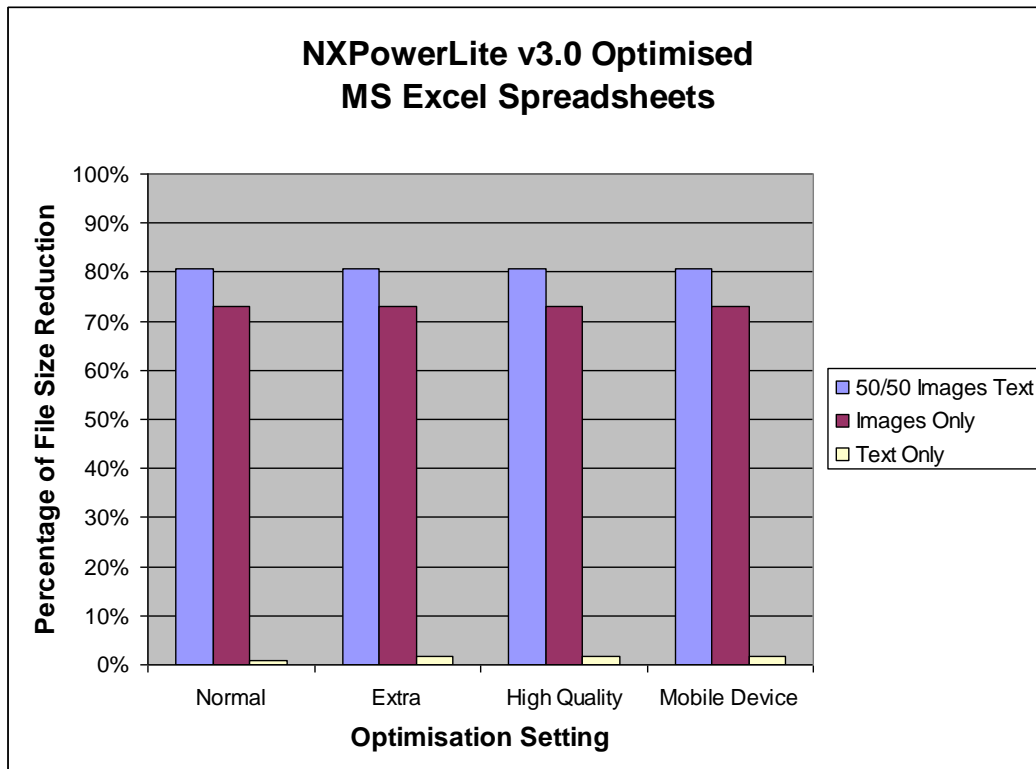


Figure 11 - NxPowerLite Version 3.0 MS-Excel Optimization

The testing of a range of MS Office files showed that Office files with embedded pictures or graphics were more predisposed to optimization. Text only Word documents were optimized by just over 50%, but practically no optimization was achieved on text only Excel spreadsheets. Changing the level of optimization did not result in a reduction in file size for text-only Word documents.

There was no or very little difference in performance achieved between the different optimization settings on Excel spreadsheets.

On average (text-only files excepted), NxPowerLite 3.0 provided the following optimization on the MS-Office files tested:

	<b>High Quality % Reduction</b>	<b>Normal % Reduction</b>	<b>Extra % Reduction</b>	<b>Mobile % Reduction</b>
<b>MS-Word</b>	<b>71%</b>	<b>68%</b>	<b>84%</b>	<b>84%</b>
<b>MS-Excel</b>	<b>76%</b>	<b>76%</b>	<b>76%</b>	<b>76%</b>
<b>MS-PowerPoint</b>	<b>77%</b>	<b>84%</b>	<b>88%</b>	<b>96%</b>

There is an unexpected disparity between High Quality and Normal Optimization regarding MS-Word files that warrants readdressing on a larger data set. It is also notable that NxPowerLite reduces the size of text-only Word files in this data set by over 50% and text only PowerPoint files by 32%. The overall results show that NxPowerLite 3.0 significantly reduces the file sizes of MS-Office documents.

### **Trident Warrior 2007 – Summary of Results**

Using the data files produced at each phase, and the corresponding graphs the covering the spectrum of PowerPoint optimization as a function of JPEG image quality, an operator evaluation was performed to determine the optimum settings to balance file size reduction and quality of output. The optimized data files at each phase were visually inspected and compared using the initial un-optimized PowerPoint Presentation as the baseline. Also, once having established the usable data files a print test was performed using a standard Laser Printer to check quality as well. From a technical perspective the following are the recommended optimum NxPowerLite settings for tactical use for each of these tests.

#### **Pictures Only Test**

- Normal Compression (1024x768, JPEG Quality 6)
- Resolution 1280 x 1024, JPEG Quality 8
- Resolution 800 x 600, JPEG Quality 8

#### **Charts Only Test**

- Any of the settings were usable from both the visual and printed perspective.

#### **Graphics Only Test**

- Resolution 640 x 480, JPEG Quality 8 was usable both visual and printed
- Resolution 800 x 600, JPEG Quality 8
- Resolution 1024 x 768, JPEG Quality 8

### Mix of Elements Test

- Extra Compression usable from both the visual and printed perspective; Resolution 1024x768, JPEG Quality 6
- Normal Compression usable from both the visual and printed perspective; Resolution 800x600, JPEG Quality 6

Overall the quality and clarity of graphics after optimization had taken place were the limiting factor on the usability of the data files. If the original graphic quality was low, the optimization when performed using lower JPEG quality settings made it worse. As a result these recommendations are only guidelines.

From the web surveys, in nearly all cases, Fleet Operators reported good or satisfactory quality of the images, text, or graphics of the optimized MS Office files. The only setting deemed *not* acceptable was the Mobile Device option. This option achieved massive size reductions but came with an unacceptable loss of quality when viewed on normal PC displays.

Some users noted that they were simply not interested in changing the optimization settings and just accepted the Default Setting (1024x768, JPEG Quality =7) to optimize a file attachment when sending email from Outlook.

**Given that no users felt that there was unacceptable quality loss with the ‘Extra Compression’ optimization setting and that it offered better file size reduction than ‘Normal’ it is recommended that the default settings of NXPowerLite should be set accordingly so that when users optimize file attachments in MS Outlook this setting will be the one used.**

### Ease of Use Experiments – NxPowerLite Standalone Version

All participants conducted optimization of MS Power Point, Word and Excel presentations using a Stand-alone version of NXPowerLite. To achieve this, the operator would run NXPowerLite independently in order to access optimization. To measure and compare results, all participants prepared at least four large presentations including images (file size in excess of 5 Mbytes) as follows:

- One presentation with a large number of embedded graphic images (photos)
- One presentation with a large amount of text
- One presentation with an equal amount of image files and text (i.e. equal number of slides with images to text)
- One presentation with animations, slide transitions (using MS PowerPoint custom animation features) and an embedded MS Office object (such as a MS Excel Spreadsheet)

The data collected and analyzed was based on survey results from participants and recorded data that was captured using the TW07 Web Surveyor application. Key factors assessed in the survey results included degradation of image sharpness, color accuracy, brightness and contrast, distortion, and significant loss of image information (i.e. loss of facial recognition, hull numbers, antenna patterns and high granularity). In general, optimization results showed that reduced file sizes ranged from very good to poor depending upon the level of optimization selected.

### Ease of Use, NxPowerLite Standalone Results

Overall operators either agreed or strongly agreed with the stated survey questions. Analysis of the results answers from all respondents who took part in the survey in the 36 day period from Tuesday, 20 March 2007 – Tuesday 24 April 2007.

The results showed NXPowerLite Stand-alone version to be a self explanatory program that was easy to learn and very simple to use. The drop down menus allowed for straightforward navigation and manipulation of the tool in order to achieve desired “custom compression” levels for adding, removing and optimizing selected files.

Access to the online help file could not be achieved as the application hosted on a secure maritime network with no unclassified internet access. The 'change language' option, although easy to find, was not used often or applied during the survey period.

In summary, NXPowerLite Stand-alone was thoroughly tested and assessed during Trident Warrior 2007. Feedback from users is that NXPowerLite is a useful program that was effective, easy to configure and simple to use.

### **Ease of Use Experiments – NxPowerLite Integrated Version**

All participants conducted optimization of MS Power Point, Word and Excel presentations using an Integrated version of NXPowerLite. The integrated version enabled direct access to NXPowerLite from within MS Outlook, Windows Explorer as well as MS-Office applications, with Version 2.4.1 limited to MS PowerPoint. This negated the need to run NXPowerLite independently in Stand-alone mode in order to perform file optimization.

To measure and compare results, all participants prepared at least four large presentations including images (file size in excess of 5 Mbytes) as follows:

- One presentation with a large number of embedded graphic images (photos);
- One presentation with a large amount of text;
- One presentation with an equal amount of image files and text (i.e. equal number of slides with images to text);
- One presentation with animations, slide transitions (using MS PowerPoint custom animation features) and an embedded MS Office object (such as a MS Excel Spreadsheet)

The data collected and analyzed was based on survey results from participants and recorded data that was captured using Web Surveyor. Key factors assessed in the survey results included degradation of image sharpness, color accuracy, brightness and contrast, distortion, and significant loss of image information (i.e. loss of facial recognition, hull numbers, antenna patterns and high granularity). In general, optimization results showed that reduced file sizes ranged from very good to poor depending upon the level of optimization selected.

### **Ease of Use, NxPowerLite Integrated Results**

Overall operators either agreed or strongly agreed with the stated survey questions. Analysis of the results includes answers from all respondents who took part in the survey in the 36 day period from Tuesday, 20 March 2007 – Tuesday 24 April 2007.

One of the primary objectives was to assess Ease of Use of NXPowerLite. The results showed that NXPowerLite was a very user friendly program that was easy to set up, configure and use. The decision to use the Stand-alone or Embedded option depended on the site set up and user requirements.

In summary, the ability to choose between Stand-alone and Embedded NXPowerLite was determined by site configuration and operator preference. Feedback from users consistently agreed NXPowerLite to be a very user friendly program that required minimal training overhead to achieve confidence and familiarity in a very short time.

### **NxPowerLite Tactical Impact Experimentation**

The above data indicates that NxPlite is both effective in reducing MS-Office file sizes and is easy to learn and use. The NxPlite optimization algorithms do change the images and graphics contained in a given file. Experimentation was conducted to assess 1) whether or not the accuracy and usability of information is adversely changed by NXPowerLite optimization; 2) the effectiveness in quantitative and qualitative terms of NXPowerLite in optimizing MS-PowerPoint presentations. The goal was to determine whether or not NxPlite optimization negatively impacting the tactical application of the presentation.

### **Experiment description and context**

All participants conducted optimization of MS Power Point, Word and Excel presentations using an embedded version of NXPowerLite 3.0. The embedded version enabled direct access to NXPowerLite from within MS Outlook and MS PowerPoint. This negated the need to run NXPowerLite independently in Stand-alone mode in order to achieve access to optimization. To measure and compare results, all participants prepared at least four large presentations including images (file size in excess of 5 Mbytes) as follows:

- One presentation with a large number of embedded graphic images (photos)
- One presentation with a large amount of text
- One presentation with an equal amount of image files and text (i.e. equal number of slides with images to text)
- One presentation with animations, slide transitions (using MS PowerPoint custom animation features) and an embedded MS Office object (such as a MS Excel Spreadsheet)

The data collected and analyzed was based on survey results from participants and recorded data that was captured using Web Surveyor. Key factors assessed in the survey results included

- degradation of image sharpness
- color accuracy
- brightness and contrast
- distortion
- significant loss of image information (i.e. loss of facial recognition, hull numbers, antenna patterns and high granularity)

In general, optimization results showed that the tactical impact of reduced file sizes ranged from very good (no impact) to poor (high impact – unusable) depending upon the level of optimization selected.

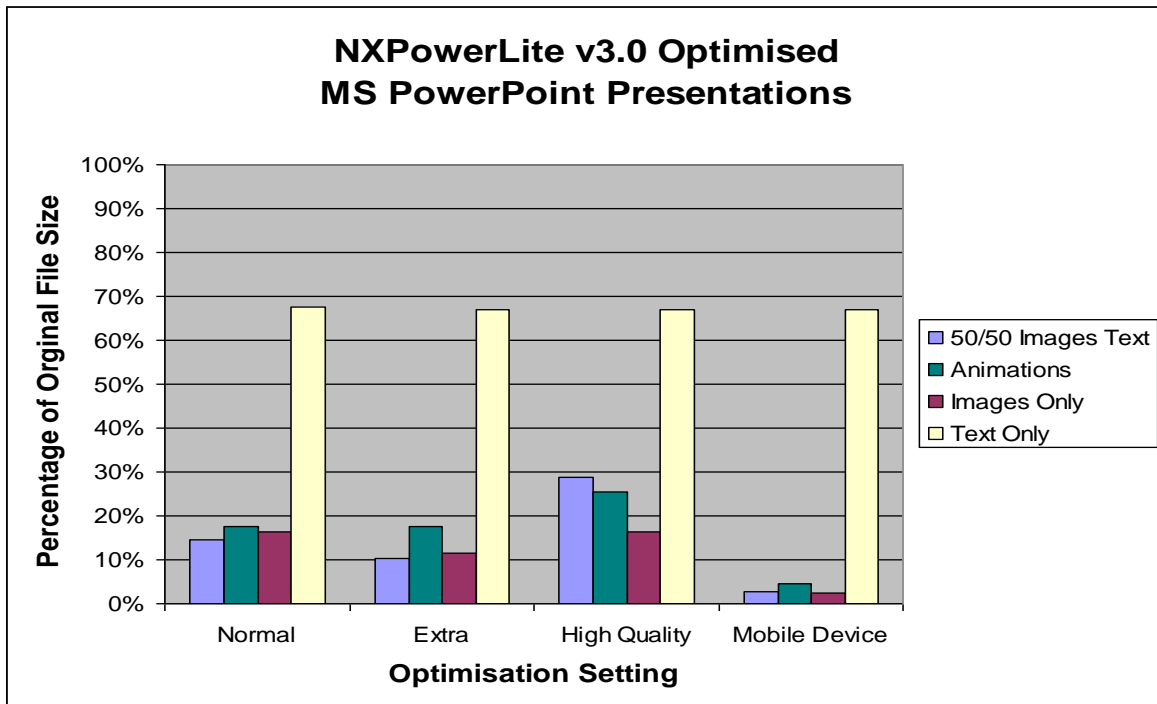
### **Results – NxPowerLite Tactical Impact Experimentation**

Overall operators either agreed or strongly agreed with the stated survey questions. Analysis of the results includes answers from all respondents who took part in the survey in the 36 day period from Tuesday, 20 March 2007 – Tuesday 24 April 2007.

The use of NXPowerLite to reduce the overall file size of Power Point presentations without negatively impacting the final presentation for final viewing was achieved with good results. The fidelity and quality of pictures, graphics, images and file size reduction depended on compression settings selected by the operator. The normal, extra, high quality, mobile device levels of compression and custom settings for JPEG generally provided the same look and feel of the original presentation although the bulk optimization function did not always work well for some users.

Operators were canvassed to ascertain their preference for use of NXPowerLite (Embedded) as part of the Power Point drop down menu, or NXPowerLite (Stand-alone) as a separate application on their desktop. Even though the embedded option provided easier access to the application, general feedback showed that no real preference was formed as both options provided sufficient quality and utility for optimization. Some operators preferred to customize their optimization options while others were happy to allow the embedded application do that for them. All operators agreed that they would make good use of NXPowerLite if it were available on their desk top computers.

Figure 122 displays the overall savings in storage space and bandwidth during transmission against the various optimization settings available.



**Figure 12 - Overall Savings in Storage Space and Bandwidth**

In summary, the ability to change compression settings in order to obtain the best compromise of image quality and file reduction was accomplished with good to very good results. One of the most user friendly aspects of the embedded version of NXPowerLite was the default feature within MS Outlook that automatically gave the operator the option of optimization prior to sending presentations, documents or spreadsheets as email traffic. This version had an immediate affect on all files being sent or received via a bandwidth friendly (SATCOM) or bandwidth constrained (Mobile devices) medium.

**Recommended Follow-on Work**

NxPowerLite is now available in version 3.5, which supports

- MS Office 97 through 2007, including the new Open XML formats (DOCX, XLSX and PPTX)
- Google Docs
- StarOffice
- OpenOffice.org

No experimentation has been done to date with Office 2007, the Open XML format or the other office productivity suites. Characterizing the performance and interoperability of these office products with NxPowerLite v.3.5 is key to maintaining Allied/Coalition interoperability, particularly with non-traditional partners, who may choose to use other office productivity software.

## **Conclusions and Recommendations**

NxPowerLite is a Microsoft (MS) Office document optimization technology, not a compression tool, with the output of the optimization process remaining a MS Office file that retains its original format. This subtle but important difference means that an optimized MS Office file can be read or edited by other parties that do not have the NxPowerLite software.

NxPowerLite can significantly reduce the size of MS Office files before transmission and therefore free up bandwidth over high latency, low bandwidth maritime network bearers. There is also a potential benefit of reducing onboard file storage requirements.

It is recommended that NXPowerLite, or a similar tool with equivalent performance and ease of use, be adopted for use on US Navy, CENTRIXS and Coalition networks in order to provide a significant savings in both transmission bandwidth and network storage of MS Word, Excel and PowerPoint files. It is recommended that the "Extra" optimization and "75dpi" settings be used as the default settings in the Maritime environment in order to maximize these savings without negatively impacting the information being shared.

In summary, NXPowerLite was thoroughly tested and assessed during Trident Warrior 2007. Feedback from users indicated that NXPowerLite is a useful program that was effective, easy to configure and simple to use. They consistently agreed NXPowerLite to be a very user friendly program that required minimal training overhead to achieve confidence and familiarity in a very short time. They all agreed that a tool such as NxPowerLite should be made available to US and Allied/Coalition maritime networks.